

PREDATORS, PARASITES, AND ASSOCIATES OF
ANTHOPHORA ABRUPTA SAY
(HYMENOPTERA: ANTHOPHORIDAE)¹

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Abstract.—Predators, parasites, and associates of the gregariously nesting solitary bee, *Anthophora abrupta* Say (Hymenoptera: Anthophoridae), were studied in Baltimore County, Maryland during 1976–1979. Adult bees were preyed on by barn swallows (*Hirundo rustica* L.) and parasitized by conopid flies (*Physocephala marginata* Say). Immature stages were parasitized by *Chrysis* sp., *Ganperdea apivora* (Aldrich), *Hornia minutipennis* Riley, and *Monodontomerus mandibularis* Gahan. Juvenile mortality was high (about 57%), and may have been contributed to by 10 species of fungi (Eumycota) infesting 50% of the bee cells. Fifteen non-parasitic insect species also nested at the study site and possibly competed with *A. abrupta* for nesting space.

Introduction

Anthophora abrupta Say is a solitary bee that nests gregariously in clay embankments or adobe structures. Each nesting female typically digs a horizontal tunnel into the soil, then constructs and provisions a series of 6–8 cells. Each lipid-lined cell contains one egg laid on the semi-solid provision, and is sealed with an earthen cap (Norden 1979). In this study, predators, parasites, and inquiline associates of *A. abrupta* were recorded.

Materials and Methods

During 1976–1979, bees were observed as they nested in the adobe walls of a farm shed in Owings Mills, Baltimore County, Maryland. Associates of *A. abrupta* were monitored daily during the 1977 and 1978 seasons. Any dead adult bees found at the site were collected in vials and returned to the laboratory for examination. At the end of nesting in 1978, 600 bee cells were also taken to the lab where they were opened and inspected.

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Results and Discussion

Barn swallows (*Hirundo rustica* L.) were observed capturing adult female bees as they flew above the shed on 23–30 May 1977. Swallows were not observed foraging on bees after 30 May and it was suspected that the emergence of worker bumblebees affected this behavior. Three bumblebee species (*Bombus bimaculatus* Cress., *Bombus nevadensis* Cress., and *Bombus perplexus* Cress.) that closely resemble *A. abrupta* also nested at the site. In contrast to *A. abrupta*, bumblebees inflict painful stings and Batesian mimicry may have discouraged the swallows from preying on bees after 30 May.

It has been noted that gregarious nesters, especially Anthophoridae, are frequently attacked by parasites (Callan 1977). In this study, five parasitic insect species were found and are considered briefly below.

1) *Chrysis* sp. (Hymenoptera: Chrysididae): These metallic green cuckoo wasps were abundant at the site (15 May–10 Sept.), and frequently were seen entering bee tunnels. Three sealed cells contained body fragments of adult *Chrysis*, but no immature stages were found. Most cuckoo wasps are external parasites of bee prepupae (Borror and DeLong 1971).

2) *Ganperdea apivora* (Aldrich) (Diptera: Anthomyiidae): The holotype and allotype of this parasitic fly were obtained from *A. abrupta* cells collected in Missouri in 1877 (Steyskal 1967). Adult flies were very common at the study site between 3 May and 19 July. Their occurrence corresponded closely to that of adult bees (13 May–15 July). *Ganperdea* flew close to the wall or crawled along its surface, frequently entering bee nests. Oviposition probably occurred while the cell was still being provisioned. One bee cell containing six fly pupae was found to have been partially provisioned, then filled with loose clay particles. Five sealed cells opened in the lab contained an average of 5.6 ± 0.5 fly pupae but no remnants of bee larvae. Bee eggs were probably killed and the provision consumed by *G. apivora* larvae.

3) *Hornia minutipennis* Riley (Coleoptera: Meloidae): Riley described this beetle from specimens also obtained from *A. abrupta* cells in Missouri in 1877. During this study, four *H. minutipennis* were found within sealed *A. abrupta* cells (April 1977 and 1978). One specimen was also removed from a spider web in the shed on 14 June 1977. Rau (1930) reported that female beetles laid their eggs in the cells in which they were reared. When the eggs hatched, the mobile triungulins (first instar larvae) crawled out from the bee cells and attached themselves to passing adult *A. abrupta*. They were then carried by adults into cells where they fed on bee eggs and cell provisions. Only adult meloids were found in this study, and all appeared to have consumed the provision but not the cell lining (see Norden et al. 1980).

4) *Monodontomerus mandibularis* Gahan (Hymenoptera: Torymidae): These minute metallic green wasps were abundant at the wall from May to October. They mated at the wall following emergence, and then females

entered *A. abrupta* nests. Bee cells ($n = 8$) contained 25.5 ± 4.5 wasp larvae which consumed bee prepupae, leaving only the prepupal skins. Evidence of more than one generation per season was provided in the laboratory where adult wasps continued to emerge during September.

5) *Physocephala marginata* Say (Diptera: Conopidae): One conopid fly emerged from a dead adult female *A. abrupta* on 8 July 1977, and another was collected as it flew in front of the shed on 23 June 1978. Conopids insert their eggs into bee abdomens during flight (Askew 1971). Bees remained active as fly larvae fed on their abdominal contents, and pupation of the conopid did not occur until after the death of the host bee.

Also noteworthy was the emergence of 64 *Pediobius williamsoni* (Girault) from the body of a dead female *A. abrupta* collected on 27 June 1976. These wasps were probably parasitoids of a conopid parasitizing the bee (E. E. Grissell, pers. comm.).

Bees may also have succumbed to fungal infections. Examination of cells ($n = 600$) in the laboratory revealed that 343 (57.4%) were infested by fungi (Eumycota). Of these, 50.2% were completely filled with fungal mycelia which had destroyed brood and provisions, while 7.2% contained living prepupae with fungal growth limited to cell caps. Fungi were identified as follows:

Order Eurotiales

Sporothrix sp.

Order Moniliales

Aspergillus niger van Tiegh.

Cladosporium sp.

Fusarium sp.

Paecilomyces sp.

Sporodesmium sp.

Order Mucorales

Mortierella sp.

Mucor sp.

Rhizopus sp.

Order Sphaeriales

Kernia sp.

Fusarium is known to be a facultative parasite of bees (Batra et al. 1973), however, we could not determine whether this or other fungi were responsible for larval death. Bees killed by other causes might later have become infested by saprophytic fungi.

Whatever the causes of death, we found a juvenile mortality rate of about 57%. *Anthophora linsleyi* Timberlake exhibited a similarly high mortality rate (about 50%), while maintaining a stable population (Linsley and

MacSwain 1942). Apparently, *A. abrupta* also produced sufficient cells to offset this high juvenile loss since the population did not appear to change significantly during this study.

In addition to those organisms directly effecting *A. abrupta*, we also found several non-parasitic insect species in close proximity to active bee nests. These associates may compete with *A. abrupta* for nesting space, as they were found inhabiting old nest cavities. They included:

Anthophoridae

Anthophora bomboides Kirby

Apidae

Bombus bimaculatus Cress.

Bombus nevadensis Cress.

Bombus perplexus Cress.

Eumenidae

Ancistrocerus unifasciatus (Saus.)

Stenodynerus sp.

Symmorphus sp.

Megachilidae

Megachile latimanus Say

Osmia lignaria Say

Prochelostoma philadelphi (Robt.)

Pompilidae

Agenioideus humilis (Cress.)

Sphecidae

Crossocerus sp.

Trypoxylon clavatum Say

Trypoxylon kolazyi Kohl.

Vespidae

Polistes fuscatus F.

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